Going driverless

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Going driverless: the legal consequences of making the human driver redundant

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Abstract

Automated driving is getting increasingly more attention. More and more cars are equipped with self-driving features and fully automated driving is getting closer to reality by the day. Trials with self-driving vehicles are currently taking place across the globe. However, before handing over control to the automated vehicle, there are challenges to overcome. These are not only technical challenges but also legal challenges. Although the driver becomes redundant from a technical perspective, from a legal perspective this is not the case. Laws will have to be adjusted to accommodate this new technology. This paper will give a short overview of the legal challenges ahead, especially the challenges regarding technical regulations, traffic laws and liability.

Keywords: automated driving; self-driving car; autonomous vehicle; driver; traffic law; liability

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1. Introduction

As trials with (semi) autonomous vehicles are taking place across the globe, a driverless future is getting closer to reality. For a driverless future to become reality, however, there are not only technical hurdles but also legal challenges to overcome. For instance, traffic laws are based on the notion that a human driver is necessary in order to drive the vehicle. If the human driver becomes redundant, these laws will have to be adjusted to allow driverless vehicles to drive on public roads. The transition to a driverless era will not happen overnight. Therefore, laws will also have to accommodate different levels of automation, from the situation where a conventional driver is driving the vehicle up to the situation where a vehicle can operate completely independent.

These different levels of automation are described by SAE International (SAE International (2016)). SAE International makes a distinction between six levels of automation, ranging from Level 0 (no driving automation) to level 5 (full driving automation). Vehicles up to Level 2 (partial driving automation) are already on the public roads today. These vehicles are able to perform a part of the driving task. For example, the vehicle stays within its own lane (lane keeping) or keeps a set speed and is able to adjust its speed to keep a safe distance from the vehicles driving in front of it (adaptive cruise control). Vehicles from Level 3 onwards are capable of performing the entire driving task, but up to Level 4 a human driver should be able to intervene under certain circumstances. A person needs to intervene when a problem occurs or when the situation that the vehicle can handle itself – for instance driving on a highway – comes to an end. A Level 4 vehicle needs to be able to bring itself to a safe stop if the person fails to respond to a request to intervene. A Level 3 vehicle disengages after an appropriate time after issuing the request to intervene, it does not achieve a minimal risk condition like a Level 4 vehicle. No human interference is necessary at the highest level of automation, Level 5 (full driving automation). The person using a Level 5 vehicle no longer needs to keep his eyes on the road, ready to take over the driving task. This person can read a book, write an email, or sleep while the vehicle is driving him to his destination.

From a legal perspective, vehicles up to Level 3 have a driver, a human that determines speed and direction of the vehicle, that observes the traffic situation and makes decisions based upon those observations (all the driving tasks). The driver using a Level 3 vehicle must always be ready to intervene. When the self-driving vehicle system of a Level 4 vehicle is not engaged, a person needs to perform the driving tasks just like a conventional driver. This person is at that moment the driver of the Level 4 vehicle. If the vehicle system is engaged, the person using the vehicle does not perform the driving tasks, the self-driving vehicle system performs the driving tasks. It is no longer clear if, from a legal perspective, such a Level 4 vehicle with the self-driving vehicle system engaged still has a driver. After all, there is no longer a person that needs to perform a driving task. The same goes for a Level 5 vehicle, where the vehicle system performs the driving tasks during the whole trip.

The absence of the conventional driver gives rise to several legal questions, most importantly regarding technical regulations, traffic laws and liability. In all these fields the conventional driver plays an important role in legislation. Rules are addressed to the driver and duties are laid upon the driver. In technical regulations reference is made to the driver for instance in provisions regarding the position of steering equipment. Traffic laws include duties of conduct addressed to the driver, for example, on which side of the road to drive on. And depending on national liability laws, the driver will have to pay damages to compensate for the damage he caused whilst driving.

Road safety should be the starting point when answering the legal questions regarding the absence of the driver as technical regulations, traffic laws and liability laws all aim to increase road safety. Technical regulations do so by laying down minimum requirements for vehicles, traffic laws by providing rules of conduct and liability laws by, in case it does go wrong, allocating the damage from the victims to the perpetrator. This can have a deterrent effect and therefore stimulate safe behavior. The aim when adjusting (if indeed necessary) laws to autonomous vehicles should therefore be not to adversely affect road traffic safety in doing so.

In this paper several legal questions regarding self-driving vehicles (Level 4 and Level 5) and technical regulations (section 2), traffic laws (section 3) and liability laws (section 4) will be discussed. Some other legal questions will be touched upon briefly in section 5. However, this is not a complete overview of all the legal questions surrounding automated driving.

2. Technical regulations

References to a driver are made in technical regulations. Take for instance the UN Regulations, which are addenda to the 1958 Agreement concerning the Adoption of Uniform Prescriptions. These UN Regulations – of which there are more than 160 – cover a wide array of subjects like the steering mechanism, rear marking plates for slow-moving vehicles, the strength of the seats, braking, the heating system, the recyclability of motor vehicles, and so on. References to the driver are made throughout the UN Regulations. An example of this can be found in the description of the characteristics of the braking systems:

"There shall be at least two controls, independent of each other and readily accessible to the driver from his normal driving position. Every brake control shall be designed such that it returns to the fully off position when released. This requirement shall not apply to a parking brake control when it is mechanically locked in an applied position;(…)" (Regulation No. 13-H.)

When self-driving vehicles make the human driver redundant, how can these technical regulations apply? Self-driving vehicles will have to comply with technical regulations, just like a conventional vehicle. New provisions will need to be drafted, other provisions might still apply to automated vehicles. Regarding some regulations a novel interpretation might provide a solution. Google raised this issue in the United States on the interpretation of the American Federal Motor Vehicle Safety Standards (FMVSS). Google asked the National Highway Traffic Safety Administration (NHTSA) if regarding some FMVSS the self-driving vehicle system could be deemed to be the driver of the vehicle. One of the provisions discussed by the NHTSA is FMVSS no. 101 section 5.1.1:

"S5.1.1 The controls listed in Table 1 and in Table 2 must be located so they are operable by the driver under the conditions of S5.6.2."

Table 1 and table 2 list controls and telltales like turn signals, the windshield wiping system, brake system malfunction, fuel level, engine start control and the horn. Google argues that these controls are operable for the self-driving system. For the purpose of S5.1.1, the NHTSA interprets the self-driving vehicle system to be the driver. The NHTSA states that it is more reasonable to identify the driver as whatever, not whoever, is doing the driving. In case of a self-driving vehicle, this is the self-driving vehicle system. The NHTSA reaches the same conclusion regarding several other FMVSS. Such an interpretation can also provide a solution for the UN Regulations, like the example on the characteristics for braking systems mentioned above. On the other hand, interpretation can also lead to unclear results. Therefore, on the longer term, new legislation might be needed.

3. Traffic laws

3.1. Old rules, new technology

Questions also arise regarding traffic rules. These questions have an international dimension as a lot of national traffic laws are based on two conventions of the United Nations: the Geneva Convention on Road Traffic of 1949 and the Vienna Convention on road traffic of 1968. Both Conventions were established to promote international traffic and to increase road safety through adoption of these uniform rules. The Conventions entail both rules of conduct and technical provisions. The general view expressed in literature is that a vehicle cannot be allowed onto the public roads if it cannot comply with the rules of conduct, even though it does not violate the technical provisions (Van Wees 2015). The Conventions both date back to a time where self-driving vehicles were not much more than a dream or perhaps something you would see in a movie. It is therefore not surprising that the self-driving vehicle was not taken into consideration while drafting these Conventions (Smith (2014)). What role does the notion of driver play in these Conventions?

3.2. A moving vehicle has a driver who is able to control his vehicle

Both the Geneva Convention and the Vienna Convention clearly state that every vehicle should have a driver (article 8 paragraph 1 Geneva Convention; article 8 paragraph 1 Vienna Convention). This driver should be able to control his vehicle (article 8 paragraph 5 Geneva Convention; article 8 paragraph 5 and article 13 paragraph 1 Vienna Convention). Both Conventions also provide a definition for the term 'driver'. According to article 4 of the Geneva Convention 'driver' means "any person who drives a vehicle, including cycles, or guides draught, pack or saddle animals or herds or flocks on a road, or who is in actual physical control of the same (…)". The definition given by the Vienna Convention differs from the definition given by the Geneva Convention. This

definition (article 1 (v) Vienna Convention) reads: ""Driver" means any person who drives a motor vehicle or other vehicle (including a cycle), or who guides cattle, singly or in herds, or flocks, or draught, pack or saddle animals on a road (…)".

Although the Conventions revolve around the notion of driver, this does not necessarily have to be a problem when the human driver becomes redundant. Some traffic rules might still be applicable to self-driving vehicles. However, some traffic rules will no longer be relevant in a driverless era or might even inhibit self-driving vehicles from driving on public roads. What problems occur when vehicles become driverless? A selection of provisions from both Conventions will be discussed below to illustrate this.

3.2.1. Headlights

Article 15 paragraph 1, first sentence, of the Geneva Convention is on the lights of a vehicle: "From nightfall and during the night, or when atmospheric conditions render it necessary, every vehicle or combination of vehicles on a road shall show at least one white light in front and at least one red light in the rear.(…)." This technical rule of the road can still apply to autonomous vehicles, whether the car drives itself or is driven by a conventional driver is not relevant regarding this provision.

3.2.2. Opening of doors

Article 24 of the Vienna Convention reads: "It shall be prohibited to open the door of a vehicle, to leave it open, or to alight from the vehicle without having made sure that to do so cannot endanger other road-users." This provision is not addressed to someone specific, for instance 'the driver'. When applying this provision to a driverless vehicle this would mean that the car itself can not automatically open its doors without having made sure that doing so cannot endanger other road-users. Applying the provision to a self-driving vehicle does not lead to unclear results. Therefore it does not need to be adjusted to an era without the conventional driver.

3.2.3. Driving permit

The provisions on driving permits (article 24-25 Geneva Convention, article 41-43 Vienna Convention) will remain relevant during the transition period. These provisions entail that every driver of a motor vehicle should hold a driving permit. It can be argued that, because a Level 5 vehicle (or the self-driving vehicle system) performs all the driving tasks without human interference, the vehicle (or the vehicle system) is the driver of this vehicle. Does this mean that a self-driving vehicle would also need to hold a driving permit (Sivak and Schoettle (2015))? This is somewhat hard to imagine, especially when the self-driving vehicle will already be approved before being allowed on to the public roads.

3.2.4. Distracted driving

Article 8 paragraph 6 of the Vienna Convention states that drivers should minimize any activity other than driving. The use of a mobile phone while driving is explicitly addressed in this provision: the national legislator should prohibit drivers to use a hand-held phone while the vehicle is in motion. Can a user of a Level 5 vehicle, who only determines the destination and the moment the trip commences, be regarded to be the driver of that vehicle? If that would be the case, he is not allowed to use his mobile phone during the trip and he should minimize all other activities other than driving. So no reading, eating, working or sleeping during the trip. This would take away many of the benefits of a Level 5 vehicle.

3.2.5. Overtaking

Some provisions are addressed directly to the driver. An example of this is article 11 of the Vienna Convention (see also article 11 of the Geneva Convention). Paragraph 1 of this article reads:

"Drivers overtaking shall do so on the side opposite to that appropriate to the direction of traffic."

This paragraph describes the duty a driver has when overtaking. If there is no longer a person behind the wheel but the vehicle itself performs the driving tasks, who or what has this duty than? This depends on who or what is the driver. Perhaps the definitions of the notion of driver given in the Conventions offer such room for interpretation that a self-driving vehicle (system) is also to be regarded to be the driver, similar to the interpretation of several FMVSS by the NHTSA mentioned above. This option will be explored further in the

following section.

3.3. Who or what drives a driverless vehicle?

The questions on the applicability of the provisions on driving permits, overtaking, and distracted driving to autonomous vehicles all boil down to one question: who or what is the driver? As mentioned above, perhaps the Conventions can be interpreted in such a way that the driver is not only the human sitting behind the wheel, but also the self-driving vehicle system.

3.3.1. A legal person behind the wheel?

Of course, the conventional driver fulfils the definitions given in the Conventions. This conventional driver is the human sitting in the driver's seat with his hands on the steering wheel and ready to use the brake or accelerator pedal. However, the Conventions speak of 'any person', not explicitly about a human (Smith (2014)). This leads to the question if perhaps a legal person, who has rights and duties just like a human, can be the driver of a motor vehicle. This legal person could for example be the company providing the software of the self-driving car. It can be argued that such a software company does the same as a conventional driver: it determines speed and direction of the vehicle and it makes strategic decisions by programming the software a certain way. However, when considering the whole Conventions, it becomes clear that the traffic rules in the Conventions are not fully applicable to a legal person. Take for instance the examples on overtaking, distracted driving and driving permits: those provisions have clearly been drafted with a human driver – the conventional driver – in mind.

3.3.2. Is the vehicle system the driver?

As mentioned above, the NHTSA deems the self-driving vehicle system to be the driver regarding several FMVSS. The NHTSA sees it as more reasonable to identify the driver as whatever, not whoever, is doing the driving. After all, if the vehicle system is able to determine the lateral and longitudinal direction of the vehicle, has situational awareness and is capable of responding to that situation, the vehicle system performs the complete driving task like a conventional driver. Does the same reasoning apply to the provisions in the Geneva Convention and the Vienna Convention? Given the definition of driver in both Conventions, the driver is 'any person' that drives the vehicle. This would exclude the vehicle system from being a driver, because the vehicle system can hardly be regarded to be a legal person (having rights and obligations) or a human.

If, however, the definition of driver would be omitted from the Conventions through amending the Conventions, this would provide room for interpreting (article 31-33 Vienna Convention of the law of treaties) the term 'driver' in other provisions of the Conventions as being the vehicle system (Smith (2014)). A driver could then be interpreted as whatever is doing the driving, the same approach as NHTSA took regarding the FMVSS. There is however an important difference between the 'driver' in technical regulations and the 'driver' as used in traffic laws like the Conventions; the notion of 'driver' has a different role in these Conventions. In technical regulations the term 'driver' is used to determine the object in the car that will perform the driving task. This driver does not have any rights or duties. This is different from the use of the notion of 'driver' in traffic laws: here the driver does have rights and duties. For instance, the driver has the obligation to keep sufficient distance from the vehicle travelling in front of him (article 13 paragraph 4 Vienna Convention) and he should avoid driving behaviour likely to endanger pedestrians (article 21 paragraph 1 Vienna Convention). Some of these obligations, like keeping sufficient distance, can be fulfilled by a vehicle system. Other obligations cannot be easily met by the vehicle system.

3.3.3. Is the person using the self-driving vehicle the driver of this vehicle?

Another option that needs further exploring is if the person who uses the self-driving vehicle, by setting the destination and switching on the vehicle system, can be regarded to be the driver of the vehicle.

The definitions of the term 'driver' given in the Conventions state that any person "who drives" a vehicle is to be regarded to be the driver of that vehicle (article 4 paragraph 1 Geneva Convention; article 1(v) Vienna Convention). Does the user 'drive' the vehicle by determining its destination and pressing the start button? The answer to this question depends on how 'driving' is to be interpreted, as neither Convention provides for a definition of 'driving'. For the interpretation of the term 'driving', the distinction between role of the conventional driver and the role of the conventional passenger could provide a clue. Neither Convention provides a definition for passenger, but it appears from the overall Conventions that the persons inside the

vehicle that do not in any way contribute to the movements of the vehicle – they do not touch the steering wheel, nor the gas pedal or other equipment necessary for determining the movements of the vehicle – are regarded passengers. The passengers are passive. The conventional driver, on the other hand, is actively involved in determining the vehicle's speed, direction and he makes strategic decisions based on his observations (stopping for a red traffic light, giving way, slowing down around schools, etc.). The driver should perform all of these driving tasks, but if he no longer performs (one of) these task, for instance because he gets distracted, he remains the driver. After all, every moving vehicle has a driver (article 8 paragraph 1 Geneva Convention; article 8 paragraph 1 Vienna Convention). One way to look at this is that the distracted driver remains the driver of the vehicle because he has the intention to drive. This distinguishes the driver form the passenger; the passenger has no intention to drive. It can also be argued that the distracted driver remains the driver because he is the one who should have been performing the driving tasks (see for instance regarding Dutch law: Vellinga, Vellinga and Van Wees (2016), Hamer and Van Poelgeest (2006)). It is important to note that the Conventions do not state that the driver should be in control of its vehicle at all times. Instead, the Conventions state that the driver "shall at all times be able to control his vehicle" (article 8 paragraph 5 Geneva Convention; article 8 paragraph 5 Vienna Convention).This implies that at times the driver does not have to be in control (Smith (2014)).

With regards to the question if the user of the autonomous vehicle can be regarded to be the driver of the vehicle, a distinction between Level 4 and Level 5 vehicles needs to be made.

Level 4 vehicles can either be driven by the person using the vehicle and by the vehicle system. When the person using the car is driving – determining speed, direction and making strategic decisions – the situation does not differ from the conventional situation of a conventional car driven by a conventional driver. Therefore, for this part of the journey the user can be characterized as the driver. Once this user switches on the self-driving system, for instance on the highway, it becomes less clear if this person is still the driver. The user hands over control to the vehicle system for the time he sees fit. If he wants to reassume control, he can. The user can at all times take the driving into his own hands again. So, the user can still fulfil all driving tasks. But does he still have the intention to drive, or does he have the intention to let the vehicle system do the driving?

Regarding level 5 vehicles, the position of the user is much clearer. The user has no intention to drive, he has the intention to let the vehicle system do the driving for him. After all, that is the whole goal of a Level 5 vehicle: letting the system drive, not the user. So, the user of Level 5 vehicles is not the driver of such a vehicle.
If this interpretation is the interpretation the parties tend towards, remains to be seen. In the United Nations Global Forum for Road Traffic Safety (Working Party 1), which primary function it is to serve as guardian of the United Nations legal instruments aimed at harmonizing traffic rules, discussion on the interpretation of the Conventions is ongoing.

3.4. The Conventions and the driverless future

The aforementioned Working Party 1 is exploring how the Conventions can keep up with the technological developments. The discussion on the interpretation is ongoing (WP.1 (2016), article 31-33 Vienna Convention of the law of treaties). A broader interpretation of terms like 'driver' could accommodate some technical developments under the Conventions (Smith (2014)). Through interpretation, the Conventions can be updated without having to go through a lengthy process of amending the Conventions (article 31 Geneva Convention; article 49 Vienna Convention). However, this flexibility comes with legal uncertainty. Changing interpretation causes uncertainty for, for instance, vehicle manufacturers: what should their vehicle be able to do, should there be a possibility for a human to intervene?

Another way to keep the Conventions in check with technological developments is amending the Conventions. This would provide for legal certainty and can be more selective than interpretation (for instance amending one specific provision instead of a novel interpretation of a term that can affect the whole convention). It is however not very suitable to quickly react to the newest technological developments as amending the Conventions is a time-consuming process. It could also be difficult to predict how the Conventions should be amended, as the technological developments are hard to predict.

Working Party one is also exploring the possibility to create a non-binding advisory instrument or Resolution, which would serve both Conventions (ECE/TRANS/WP.1/157, nr 22, WP.1 (2017c)). The discussion on these legal instruments and on what they should entail is still ongoing.

4. Liability

One of the major questions raised by the arrival of autonomous vehicles is the one on liability: who is to be held liable for damage caused by the self-driving vehicle? If an accident between two conventional vehicles occurs, one of the drivers is often blamed for it. The driver could have overlooked the other vehicle, or maybe he ignored a red traffic light. This driver will have to compensate for the damage he caused to the other party. The situation will become more complicated if it was a self-driving vehicle overlooking the other vehicle or ignoring the red traffic light. There is no longer a conventional driver who responded to the situation; the self-driving vehicle responded to the situation.

Who is to be held liable for damage caused by the self-driving vehicle is mainly determined by national law (see for instance Van Dam (2013)). Therefore, this article will only give a short overview of possible stakeholders that could be held liable for damage or personal injury caused by a self-driving vehicle. This will be done from a Dutch (and European) perspective, as the author has a background in Dutch law.

4.1. Liability of the driver or user of the self-driving vehicle

Can the person using the self-driving vehicle (Level 4 or Level 5) be held liable? After all, if this user had not summoned the vehicle to drive to a certain destination the accident would probably have never occurred. It can be argued that the user accepted the risks inherent to an autonomous vehicle; now the risks have realized the user should be held liable for the damage. Or perhaps the user did not override the system even though he had the possibility to do so (Marchant and Lindor (2012)). On the other hand, the user could not in any way influence the driving behaviour of the vehicle (unless there is an emergency brake in the vehicle, omitting operating this emergency brake could also lead to liability) and the user could have had the legitimate expectation the vehicle was able to handle the particular situation.

4.2. Liability of the owner of the vehicle

Although the owner or holder of the self-driving vehicle might not have been using the vehicle when the accident occurred, he could still be liable under certain circumstances (Schrader (2015), Engelhard (2017), Schellekens (2015)). For instance, depending on national legislation, the owner of the vehicle could be liable if he has not maintained his vehicle. He could be held liable if he failed to replace a broken sensor if this broken sensor was the cause of the accident. Or perhaps the owner did not install the software update he was notified about, which caused the vehicle not to recognize and react appropriately to the red traffic light.

What if the owner did everything – replacing and cleaning the sensors, updating the software, frequently bring the vehicle to the garage to get it checked, etc. – that can be expected of him, is there a possibility to hold the manufacturer liable? For instance, if the accident is caused by a defective sensor, or by a programming failure in the software of the vehicle system?

4.3. Liability of the manufacturer of (parts of) the vehicle

If, for example, it turns out that the accident is caused by a defective sensor, the injured party could try to get compensation for his damage from the manufacturer of the sensor or the manufacturer of the entire vehicle.
Within the European Union, the liability for a defective product is governed by Directive 85/374/EEC of 25 July 1985 (Product Liability Directive). An in-depth study of the Directive goes beyond the scope of this paper, but a few issues will be discussed briefly below.

Under this Directive, the manufacturer is liable for damage caused by a defect in its product (article 1 Product Liability Directive) (Van Dam (2013)). The injured party can decide who he wants to hold liable: the manufacturer of the sensor or the manufacturer of the entire vehicle (article 5 Product Liability Directive). Article 6 of the Product Liability Directive explains when a product is defective:

"1. A product is defective when it does not provide the safety which a person is entitled to expect, taking all circumstances into account, including:
(a) the presentation of the product;
(b) the use to which it could reasonably be expected that the product would be put;
(c) the time when the product was put into circulation.

2. A product shall not be considered defective for the sole reason that a better product is subsequently put into circulation."

The manufacturer is not liable if he proves, for example, that it is probable that the defect which caused the damage did not exist at the time when the product was put into circulation by him or that the state of scientific and technical knowledge at the time when he put the product into circulation was not such as to enable the existence of the defect to be discovered (article 7 Product Liability Directive)(Van Dam (2013)). A claim against the manufacturer of a defective sensor could, depending on the exact circumstances, well be successful.

If it turns out the accident was caused by a flaw in the software, a different question arises: is software a 'product' as meant in the Product Liability Directive? At the moment, this is unclear, but there is a tendency in literature to answer this question with 'yes' (Engelhard (2017), De Schrijver and Maas (2010), Reese (1994)).
In the absence of a driver of the vehicle, liability for traffic accidents could shift from the driver to the manufacturers of the vehicles involved. This could have a negative effect on innovation as liability might hold manufacturers back from bringing their newest technology to the market (Schellekens (2015), Schrader (2016), Marchant and Lindor (2012)).

4.4. Liability of the road authority

An accident can be caused by a defective sensor or a flaw in the software, but it can also be caused by a problem with the road infrastructure. A traffic light that is not functioning the way it should, for example, or missing lane markings which can cause the autonomous vehicle to lose its orientation on the road. Depending on national legislation, the road authority responsible for maintaining the road infrastructure can be held liable for damage caused by the insufficient state of the infrastructure (Van Dam (2013)).

4.5. Liability of the vehicle authority

Another entity which, depending on national legislation, could be held liable for damage caused by autonomous vehicles is the authority responsible for approving and licensing vehicles for its domestic (and European: Directive 2007/46/EC) market. If the authority has approved an autonomous vehicle that is not in conformity with the applicable regulations, it could be liable for damage caused by that vehicle. This, again, depends on national legislation.

5. More questions on the road ahead

5.1. Fundamental rights

In literature, the question has been raised if automated driving influences the exercising of fundamental rights (see for instance Stender-Vorwachs and Steege (2017)). A self-driving vehicle, to some extent, undermines the autonomy of its user as the driving decisions are made independent of the vehicle's user (Boeglin (2015), Kohler and Colbert-Taylor (2015)). Gasser argues, regarding section 2 of the German Grundgesetz on rights relating to life and physical integrity, that the limitations on the right to personal freedom and personal mobility are not violated as long as the passengers can always cause the vehicle to stop at the nearest safe location (Gasser (2015)). On an international level, the Charter of Fundamental Rights of the European Union entails provisions similar to section 2 of the German Grundgesetz (see article 2 and 3 of the Charter)(Gasser (2015)). The interpretation given by Gasser can therefore be extended to constitutions of other jurisdictions (Gasser (2015)). However, Gasser points out that the fundamental rights framework can differ significantly in many areas and therefore caution is required (Gasser (2015)).

5.2. Data recording

It seems likely that self-driving vehicles will have some sort of 'black box' or event data recorder (EDR) to record data that is gathered by the vehicle. This data can be of use in reconstructing incidents, discovering faults in the functioning of the vehicle and it can be brought forward as evidence in a court case. However, what data and how much data will be collected is not yet clear (see for the current list of the data elements that should be recorded under the US Code of Federal Regulations: 49 CFR part 563). This raises concerns on the privacy of the persons using the vehicle (Glancy (2012)). It also raises the question who is allowed to access the data and if access to the data should be provided in case of a civil lawsuit or a criminal prosecution (Anderson et al (2016), Van Wees (2011)).

5.3. Ethical aspects

There is increasingly more attention for the ethical questions surrounding the use of autonomous vehicles. The discussion mainly focusses on (a modified version) of the so-called Trolley Problem (Nyholm and Smids (2016)). If an accident is unavoidable whose lives should be sacrificed by the autonomous vehicle: the lives of its passengers,r the lives of other road users or should the vehicle be programmed in such a way that it makes the smallest number of casualties? (see also MIT's Moral Machine: http://moralmachine.mit.edu/)? In 2016, the German government appointed an ethics commission to study ethical questions, including the Trolley Problem. This study has led to the publication of twenty rules on automated driving (Ethik-Kommission (2017)). In case of an unavoidable accident, so the commission, qualification according to personal characteristics is strictly prohibited (Ethik-Kommission (2017)). The commission also raises the question if at some point in time an obligation to use automated vehicles can be imposed and if such an obligation would be acceptable from an ethical point of view (Ethik-Kommission (2017)).

6. On the road to a driverless future

With technology developing further, more attention is paid to the legal challenges concerning autonomous vehicles. Within Working Party 1, several options to accommodate automated driving under the Conventions are being explored. A novel interpretation of certain terms in the Conventions, the amending of the Conventions, and drafting a Protocol, a Resolution or similar legal instrument are options that are being discussed (ECE/TRANS/WP.1/157, WP.1 (2016,), WP.1 (2017a), WP.1 (2017b), WP.1 (2017c)). On a national level, governments are taking action as well. In Germany, modification of the Straßenverkehrsgesetz should provide clarity on which levels of automation our allowed under this law. A new Dutch bill (the so-called Experimenteerwet zelfrijdende auto, 2017) will, if it will be passed, open up the possibility to conduct trials on public roads without a human driver inside the self-driving vehicle. The United States of Transportation and the NHTSA have already published a two policy documents on automated driving (Federal Automated Vehicles Policy (2016), Automated Driving Systems (2017)) while in many American states automated vehicle legislation has been adopted (for instance in California, see Division 16.6 of the California Vehicle Code). So it seems legal developments are slowly but gradually catching up.

To make more progress, the discussion should intensify. As is already the case to a certain degree, this discussion needs to take place at an international level, given the already existing harmonization (International level: the Geneva Convention and the Vienna Convention, on a European level: products liability Directive 85/374/EEC, motor insurance Directive 009/103/EC, Directive 2007/46/EC on type-approval). This discussion should be interdisciplinary, with experts from outside the legal field providing legal experts and policymakers with more information on the capabilities of self-driving vehicles, ethical issues regarding self-driving vehicles, human-machine interaction, the impact of self-driving vehicles on the infrastructure, and so on. The findings from these different fields of expertise should be considered when drafting a legal framework. A legal framework can provide all the parties involved – local governments, users of self-driving vehicles, road users, manufacturers of self-driving vehicles, road authorities, etc. – with a clear picture of their rights and obligations, thereby contributing to the acceptance of self-driving vehicles.

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